

Appendix K. Summary of Stream Habitat Data

Table of Contents

Appendix K. Summary of Stream Habitat Data	K-1
Table of Contents.....	K-i
List of Tables.....	K-ii
List of Figures	K-ii
Appendix K. Summary of Stream Habitat Data	K-1
Summary of DEQ BURP Stream Habitat Data.....	K-1
Width-to-Depth Ratio	K-1
Pool Frequency and Quality.....	K-1
Pool-to-Run Ratios.....	K-2
Pools per Mile.....	K-2
Substrate Composition and Percent Fines	K-2
Bank Stability	K-3
Large Woody Debris	K-3
Summary of NPNF Stream Habitat Conditions for the SF CWR	
Subbasin	K-13
References	K-15

List of Tables

Table K-1. Environmental Baseline Habitat Condition (USFS 1999).....	K-13
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List of Figures

Figure K-1. Width-to-Depth Ratios of the SF CWR Subbasin from the BURP Data Set.....	K-5
Figure K-2. Pool-to-Run Ratios of the SF CWR Subbasin from the BURP Data Set.....	K-6
Figure K-3. Canopy Cover of the SF CWR Subbasin from the BURP Data Set	K-7
Figure K-4. Large Woody Debris of the SF CWR Subbasin from the BURP Data Set.....	K-8
Figure K-5. Number of Pools per Meter of the SF CWR Subbasin from the BURP Data Set.....	K-9
Figure K-6. Bank Stability of the SF CWR Subbasin from the BURP Data Set.....	K-10
Figure K-7. Average Left/Right Bank Stability of the SF CWR Subbasin from the BURP Data Set	K-11
Figure K-8. Percent Total Fines of the SF CWR Subbasin from the BURP Data Set	K-12

Appendix K. Summary of Stream Habitat Data

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Summary of DEQ BURP Stream Habitat Data

The graphs following this text summarize in a visual form the Beneficial Use Reconnaissance Program (BURP) stream habitat data collected by the Department of Environmental Quality (DEQ) in the South Fork Clearwater River (SF CWR) Subbasin for the years 1995-2000. The significance of each of the parameters is explained below and a comparison to regional references is provided. These data refer to one location in a stream, the BURP site, which is usually near the mouth, and may not necessarily be representative of the whole stream. The greater value of these data is the overall view one can get of stream habitat conditions in the SF CWR Subbasin.

Width-to-Depth Ratio

A change in the width-to-depth ratio can be used as an indicator of change in the relative balance between sediment load and sediment transport capacity. Sediment accumulation in stream channels reduces stream depth. Large width-to-depth ratios are often a result of lateral bank erosion due to increased peak flow, increased sediment availability, and eroding banks due to loss of streamside vegetation (Overton 1995 et al., Beschta and Platts 1986). The biological community suffers adverse effects from a decrease in channel depth and an increase in channel width. A decrease in depth may reduce the quantity and quality of pools, reducing available habitat for fish. The increase in width will lead to increased incidence of solar radiation and higher water temperatures. The combination of shallower pools and increased insolation can decrease the suitability of the stream for cold water fish. Width-to-depth ratios generally vary with channel type.

The SF CWR BURP width-to-depth ratios are suboptimal according to the federal Pacific Anadromous Fish Strategy (PACFISH) (USFS and BLM 1995) and state of Idaho guidance (DEQ 1996). The PACFISH objectives specify an optimal ratio of less than 10 for mean wetted width to mean depth. The DEQ (1996) *Waterbody Assessment Guidance* specifies an optimal wetted width-to-depth ratio as less than 7. Only 5 of the 103 sites surveyed had width-to-depth ratios below 10, indicating most streams are wider and shallower than they should be according to these references.

Pool Frequency and Quality

Salmonids often require backwater or dammed pools with water moving at a slow velocity to permit survival of harsh winter conditions. In addition, pools of all shapes, sizes, and quality are needed to support different age classes (Beschta and Platts 1986). Juvenile fish need shallow, low quality pools that other fish will not use, until increased growth allows them to

eventually compete without predation stress in the higher quality pools that have better food supplies and winter rearing habitat.

The frequency and size of pools is dependent on stream size, gradient, confinement, flow, sediment load, and amount of large woody debris (Overton et al. 1995). Pools characterized by low flow velocities (backwater or dammed pools) are particularly susceptible to infilling with sediment, thus the depth, area, or volume of these pools can serve as indicators of coarse sediment loading due to land management practices. Overton et al. (1995) found fewer deep pools in an intensely timber-managed watershed than in a non-timber-managed watershed. A decrease in the amount of large woody debris may lead to a reduction in the number and size of pools, and a change in peak flows will alter the ability of a stream to transport sediment, altering pool measurements (MacDonald et al. 1991). Landslides, debris flows, and other mass movements typically result in loss of pool area and volume.

Pool-to-Run Ratios

The SF CWR BURP pool-to-run ratios are optimal according to two references. A ratio of 1 to 3 is considered optimal by the *Waterbody Assessment Guidance* (DEQ 1996). A ratio of 1 to 1 is considered optimal by other experts (Platts et al. 1983). The majority of BURP sites had ratios below 1 to 1, and only 8 of the 103 sites exceeded a ratio of 1 to 3.

Pools per Mile

The SF CWR BURP number of pools per mile is well below the optimal level as rated by the *Matrix of Pathways and Indicators for Watershed Condition for Chinook, Steelhead and Bull Trout* (NMFS et al. 1998). This reference is applied locally for biological assessments required for activities on federal lands.

Substrate Composition and Percent Fines

The particle size of the bed material directly affects the flow resistance in the channel, the stability of the bed, and the amount of aquatic habitat (Beschta and Platts 1986). In addition, the size of the bed material controls the amount and type of habitat for small fish and invertebrates. If the bed is composed only of fine materials, the spaces between particles are too small for many organisms. The greatest number of species is usually associated with complex substrates of stone, gravels, and sand. Coarse materials provide a variety of small niches important for juvenile fish and benthic invertebrates. The mix of coarse particle in riffles has been shown to provide the richest aquatic insect habitat (Gordon 1992). Numerous studies have demonstrated reduced invertebrate abundance with fully embedded streambed particles (Meehan and Murphy 1991). Salmon and trout have evolved and adapted to the natural size distributions of channel sediments. It is believed that no single particle-size group will create the ideal environment for all phases of salmonid growth and survival (Beschta and Platts 1986).

The optimum spawning substrate mix appears to be gravel containing small amounts of fine sediment and some small rubble to support egg pockets and guard against bed erosion from floods (Beschta and Platts 1986). High amounts of fine sediments in spawning substrate

have been shown to be a major cause of embryo and larval mortality. Survival is high only if the eggs receive an adequate supply of oxygen, an adequate flow of water through the gravel to supply this oxygen, and necessary flows to remove metabolic wastes (Beschta and Platts 1986). Percent emergence of swim-up fry has also been shown to be reduced by too much fine sediment (<6.35 millimeters [mm]) by a number of researchers (Bjornn and Reiser 1991). When particle sizes less than 6.35 mm exceed 20-25% of the total substrate, embryo survival and emergence of swim-up fry is reduced by 50% (Bjornn and Reiser 1991).

The percent fine sediment at BURP sites is well above optimal levels as rated by DEQ (1996), fisheries researchers, and the *Matrix of Pathways and Indicators for Watershed Condition for Chinook, Steelhead and Bull Trout* (NMFS et al. 1998). Less than 10% fines is considered optimal by the DEQ *Waterbody Assessment Guidance* (DEQ 1996). The matrix of pathways guidance (NMFS et al. 1998) rates high condition habitat as that containing less than or equal to 10% fines in A and B channel types and less than or equal to 20% for C and E channel types. Ninety-eight of the 103 BURP sites evaluated exceed 20% fine sediment and 86 sites exceed 30% fines.

Bank Stability

Eroding stream banks deliver sediment directly to the channel. Steeper banks are subject to more erosion and failure, and streams with poor banks will often have poor in-stream habitat. Protection from erosion is provided by plant root systems as well as by boulder, cobble, or gravel material. Channels with banks and riparian vegetation in good condition handle flooding with less habitat damage. Channel bank conditions are closely linked to the quality of fish habitat.

Platts et al. (1983) and PACFISH (USFS and BLM 1995) rate values greater than 80% stability as excellent and as meeting interim objectives for restoring anadromous fisheries. Comparing to these standards, the bank stability for the SF CWR subbasin is generally optimal with only 23 out of the 103 sites evaluated rating less than 80% stability. The *Matrix of Pathways and Indicators for Watershed Condition for Chinook, Steelhead and Bull Trout* criteria for bank stability differs by channel type, with C channel types less than 80%, A and B channel types less than 90%, and E channel types less than 95% rated as poor condition (NMFS et al. 1988). The BURP bank stability data generally rate moderate to good condition as compared to this reference.

Large Woody Debris

Woody debris and root wads create habitat diversity by forming pools and waterfalls, trapping sediment, and enhancing channel and bank stability. Research has shown a direct relationship between the amount of woody debris and salmonid production, and woody debris removal has been shown to reduce fish populations.

The BURP data represent the number of pieces of large woody debris greater than 1 meter in length and 10 centimeters in diameter within the reach. The PACFISH (USFS and BLM 1995) objectives require more than 20 pieces per mile (1.25 pieces per 100 meters), greater than 12 inches (30.5 cm) wide and 35 feet long (10.67 meters). This reference is not directly

comparable to BURP data because the lengths and widths of pieces are not recorded. Large woody debris at most sites in the BURP data set exceeded 1.25 pieces per 100 meters with the exception of the Cottonwood watershed.

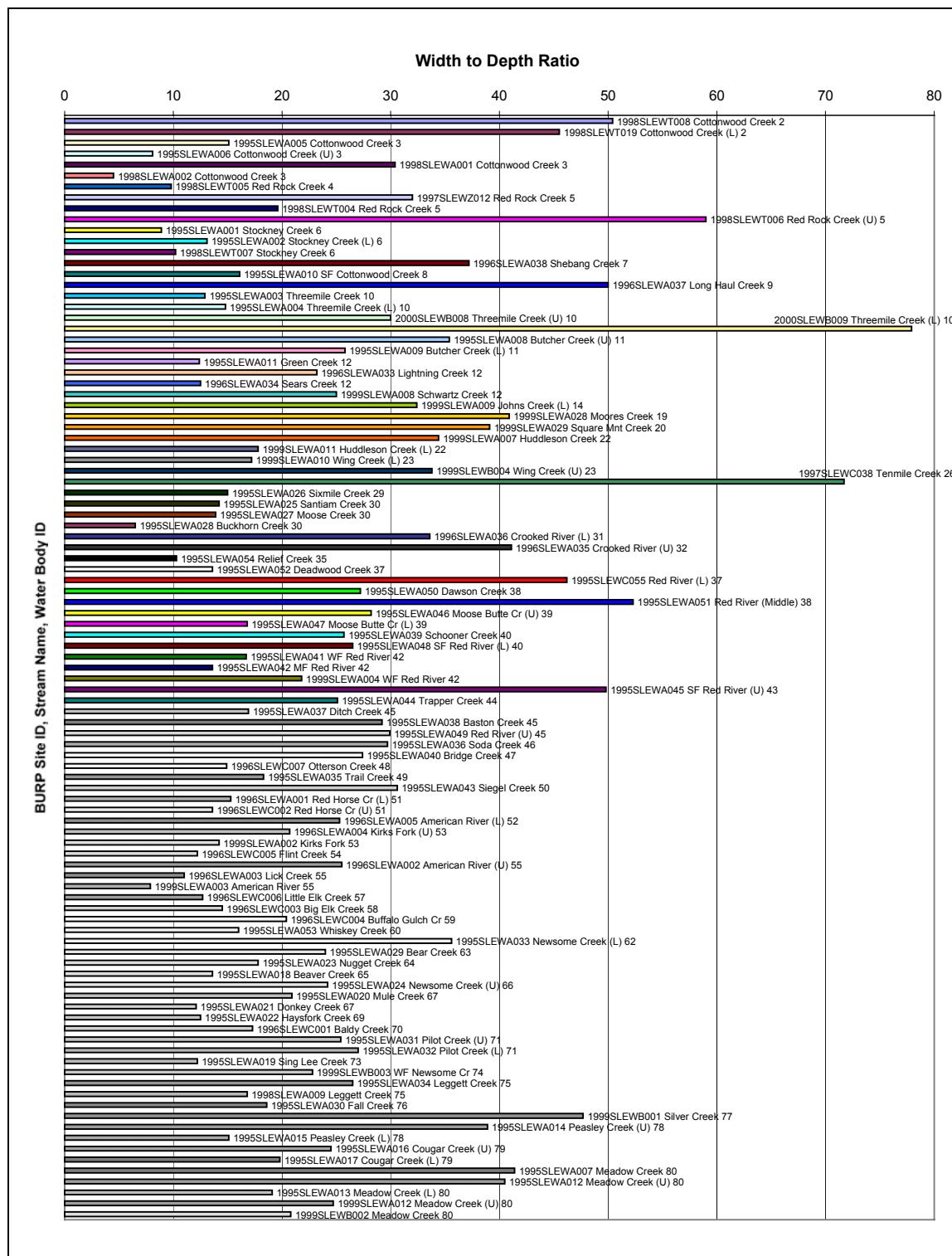


Figure K-1. Width-to-Depth Ratios of the SF CWR Subbasin from the BURP Data Set

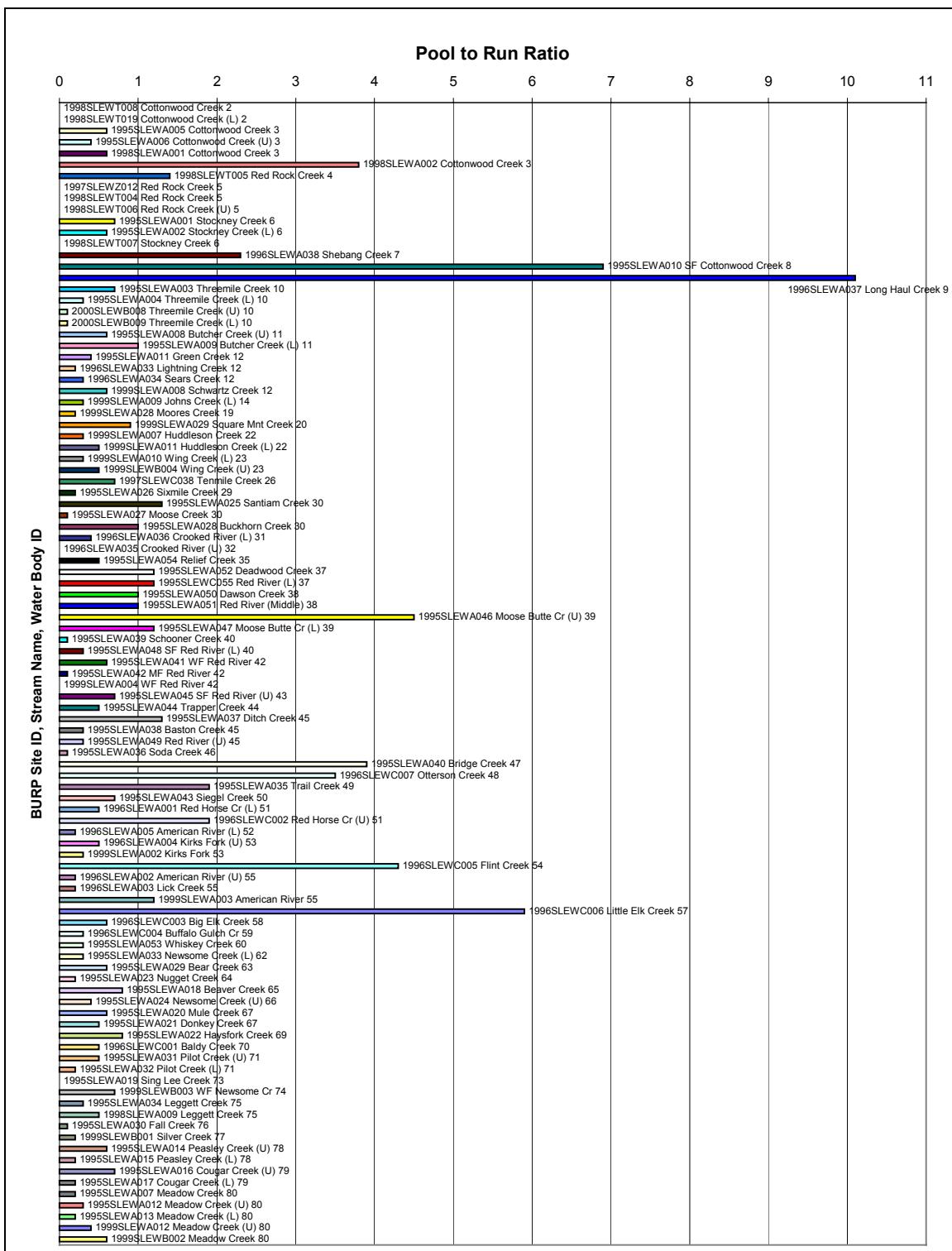
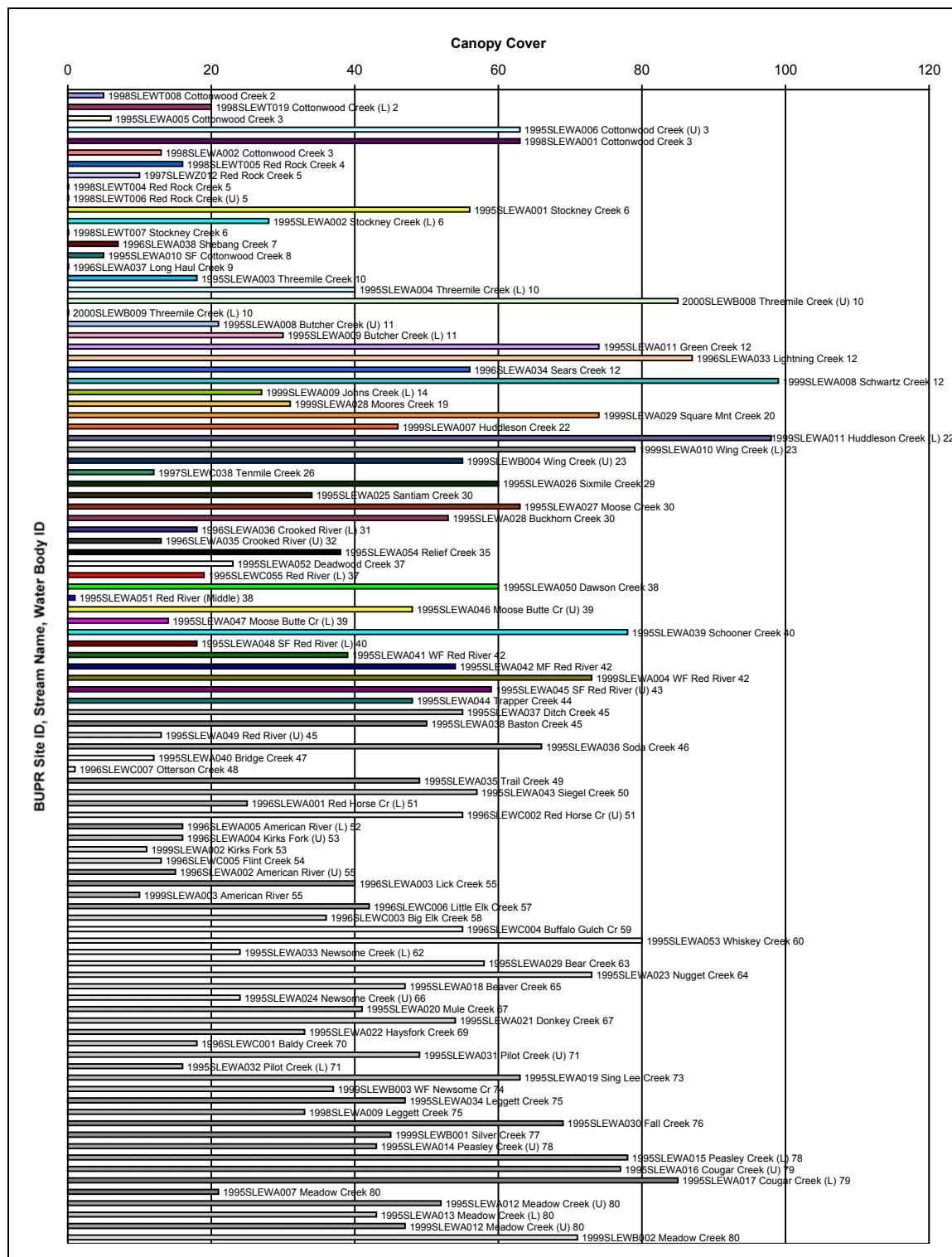


Figure K-2. Pool-to-Run Ratios of the SF CWR Subbasin from the BURP Data Set

**Figure K-3. Canopy Cover of the SF CWR Subbasin from the BURP Data Set**

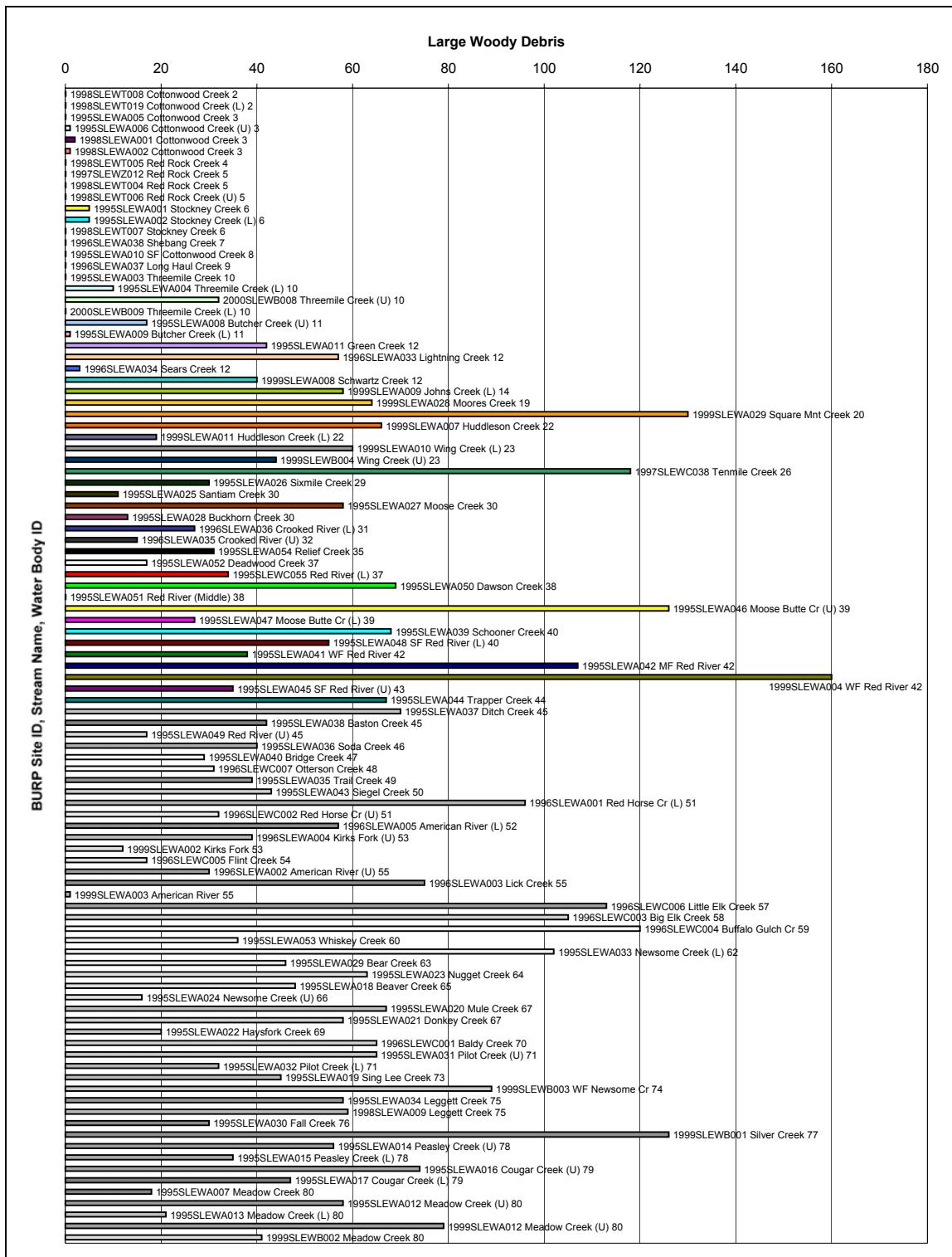


Figure K-4. Large Woody Debris of the SF CWR Subbasin from the BURP Data Set

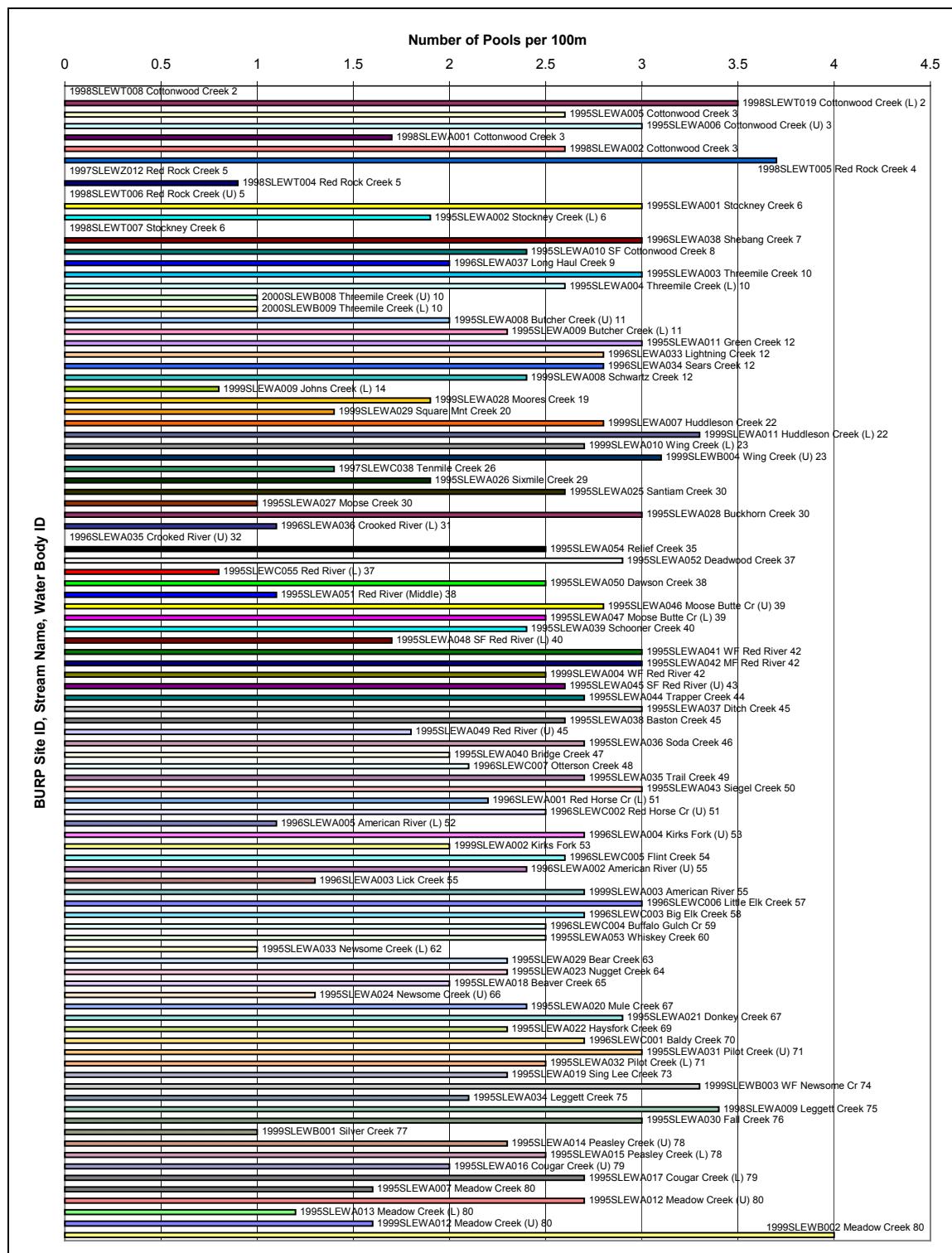


Figure K-5. Number of Pools per Meter of the SF CWR Subbasin from the BURP Data Set

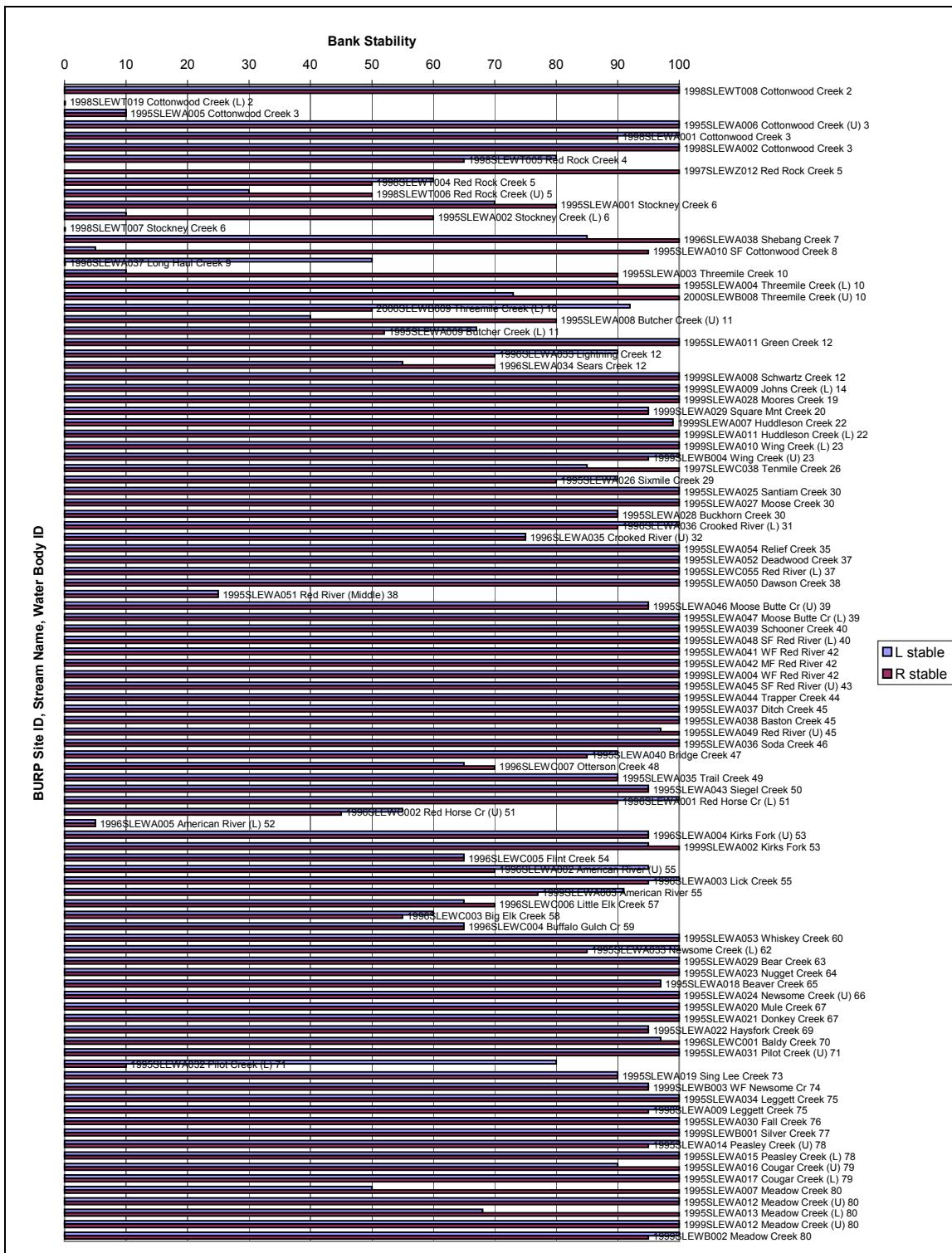


Figure K-6. Bank Stability of the SF CWR Subbasin from the BURP Data Set

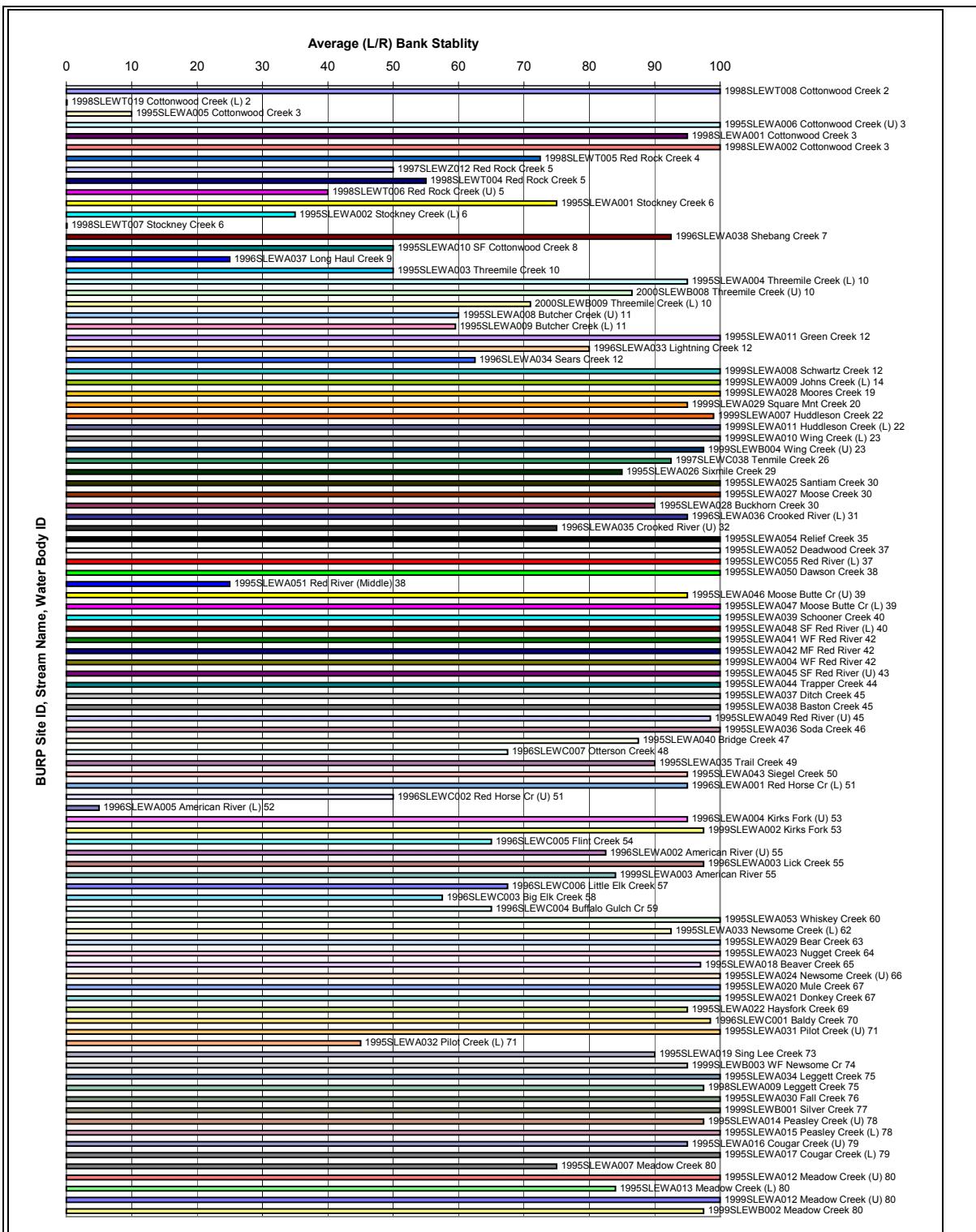


Figure K-7. Average Left/Right Bank Stability of the SF CWR Subbasin from the BURP Data Set

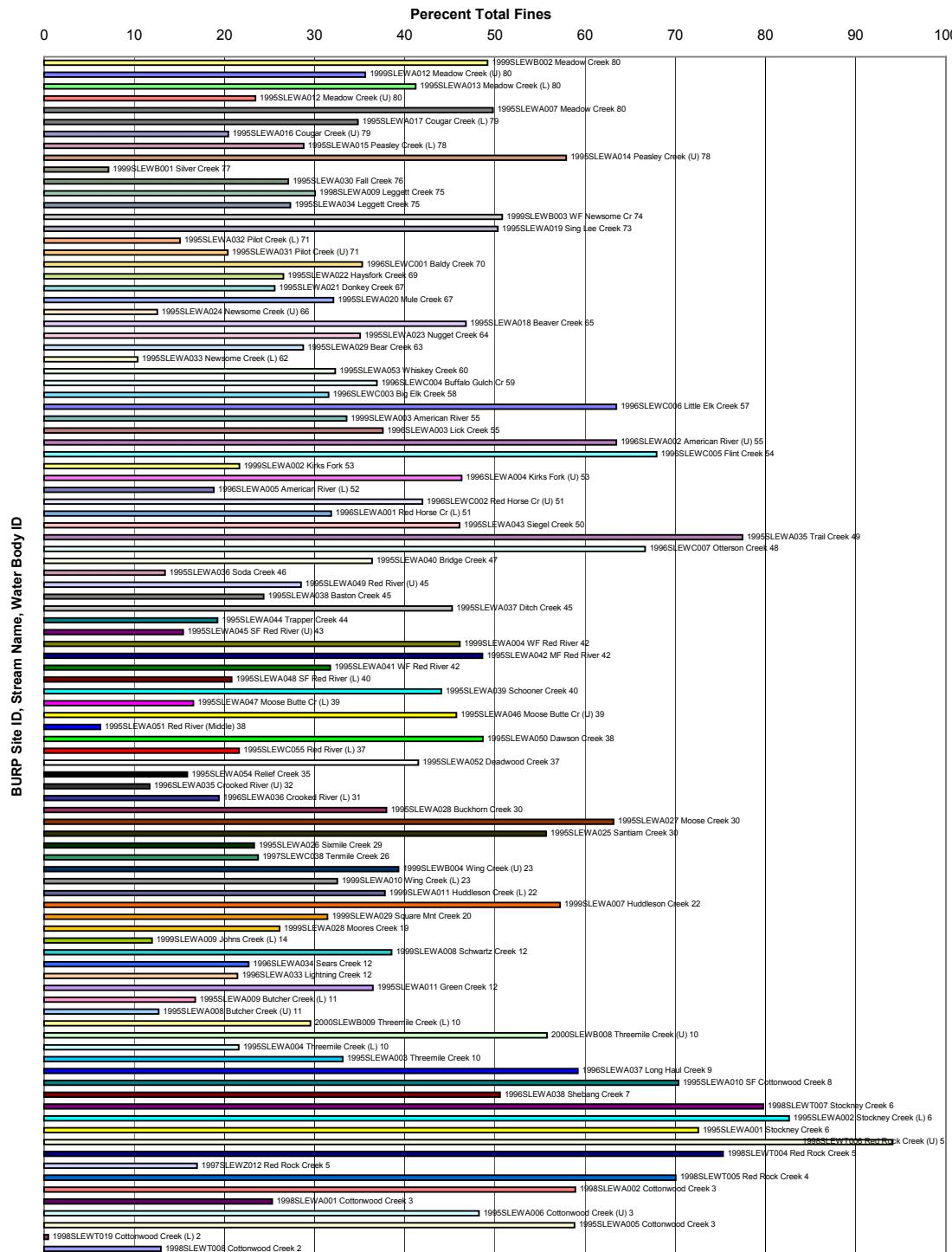


Figure K-8. Percent Total Fines of the SF CWR Subbasin from the BURP Data Set

Summary of NPNF Stream Habitat Conditions for the SF CWR Subbasin

Table K-1 below illustrates the USFS (1999) rating of the biological condition of 15 major watersheds in the SF CWR Subbasin for ESA listed species using the *Matrix of Pathways and Indicators of Watershed Condition-Local Adaptation for the Clearwater Basin* (NMFS et al. 1998). The watersheds assessed include Red River, American River, Crooked River, Newsome Creek, Leggett Creek, Tenmile Creek, Twentymile Creek, Wing Creek, Silver Creek, Peasley Creek, Cougar Creek, Johns Creek, Meadow Creek, Mill Creek, and the SF CWR main stem and face drainages. Summarized at a watershed scale, the majority of water quality and habitat elements rate as "low" condition, while watershed condition (road parameters), channel conditions, and species take (harassment, redd disturbance, juvenile harvest) rate as "moderate" condition.

Table K-1. Environmental Baseline Habitat Condition (USFS 1999).

Indicator	High	Moderate	Low
Watershed Condition			
Watershed Road Density		X	
Streamside Road Density			X
Landslide Prone Road Density		X	
Riparian Vegetation Condition		X	
Change in Peak/Base Flow		X	
Water Yield (ECA)		X	
Sediment Yield		X	
Channel Conditions and Dynamics			
Width/Depth Ratio		X	
Streambank Stability		X	
Floodplain Connectivity			X
Water Quality			
Temperature (Steelhead) Spawning			X
Temperature (Steelhead) Rearing and Migration			X
Temperature (Bull Trout)			X
Turbidity or Suspended Sediment		X	
Chemical Contaminants – Nutrients		X	
Habitat Access			
Physical Barriers – Adults	X		
Physical Barriers – Juvenile	X		
Habitat Elements			

Indicator	High	Moderate	Low
Cobble Embeddedness			X
Percent Fines (Surface or by Depth)			X
Large Woody Debris			X
Pool Frequency			X
Pool Quality			X
Off-Channel Habitat			X
Habitat Refugia		X	
Take			
Harassment		X	
Redd Disturbance		X	
Juvenile Harvest		X	
Bull Trout Sub-Population Characteristics			
Sub-Population Size		X	
Growth and Survival			X
Life History Diversity and Isolation		X	
Persistence and Genetic Integrity		X	
Bull Trout Integration of Species and Habitat			X

References

- Beschta, R.L. and W.S. Platts. 1986. Morphological features of small streams: significance and function. American Water Resources Association, Water Resources Bulletin, Vol. 22(3): 369-379.
- Bjornn, T.C. and D.W. Reiser. 1991. Chapter 4: Habitat requirements of salmonids in streams. In Meehan, W.R. Influences of forest and rangeland management on salmonid fishes and their habitat. American Fisheries Society Special Publication, Vol. 19: 83-138.
- DEQ (Division of Environmental Quality). 1996. Water body assessment guidance. A stream to standards process. Idaho Division of Environmental Quality, Boise, ID. 109 pp.
- Gordon, N.D. 1992. Stream hydrology: an introduction for ecologists. John Wiley & Sons, New York, NY. 526 pp.
- MacDonald, L.H., A.W. Smart, and R.C. Wissmar. 1991. Monitoring guidelines to evaluate the effects of forestry activities on streams in the Pacific and Alaska. EPA/910/9-91-001. U.S. Environmental Protection Agency and University of Washington, Seattle, WA. 166 pp.
- Meehan, W.R. and M.L. Murphy. 1991. Stream ecosystems: Chapter 2. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication, Vol. 19: 25-46.
- NMFS et al. (National Marine Fisheries Service, Cottonwood Bureau of Land Management, Clearwater National Forest, and Nez Perce National Forest). 1988. Matrix of pathways and indicators for watershed condition for chinook, steelhead and bull trout, local adaptation for Clearwater Basin and Lower Salmon. Unpublished guidance. 9 pp.
- Overton, C.K., J.D. McIntyre, R. Armstrong, S. Whitwell, and K.A. Duncan. 1995. User's guide to fish habitat: natural conditions in the Salmon River Basin, Idaho. USDA Forest Service Technical Report INT-GTR-322. USDA Forest Service, Intermountain Research Station, Ogden, UT. 142 pp.
- Platts, W.S., W.F. Meehan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. General Technical Report INT-138. USDA Forest Service, Intermountain Forest and Range Experimental Station, Ogden, UT. 77 pp.
- USFS (USDA Forest Service). 1999. South Fork Clearwater River biological assessment. Nez Perce National Forest, Grangeville, ID. 603 pp. +app.

USFS and BLM (USDA Forest Service and USDI Bureau of Land Management). 1995. Environmental assessment for interim strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California (PACFISH). U.S. Forest Service, Portland, OR. 72 pp.